| Centre Number | Candidate Number |
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Candidate Name ____________________

International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

**PHYSICS** **0625/6**

PAPER 6 Alternative to Practical

Monday **20 NOVEMBER 2000** Morning 1 hour

Candidates answer on the question paper.
Additional materials:
Electronic calculator and/or Mathematical tables
Ruler (30 cm)

**TIME** 1 hour

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

You may use a calculator.

| FOR EXAMINER'S USE | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| TOTAL | |

**This question paper consists of 12 printed pages.**

SB (SM/DJ) QK07578/3


**[Turn over**

1 Fig. 1.1 shows a metre rule clamped to a bench top. A mass of 50 g is attached to the free end of the rule. The weight of the rule and of the 50 g mass depresses the free end of the rule by a small distance, $x$, from the horizontal.

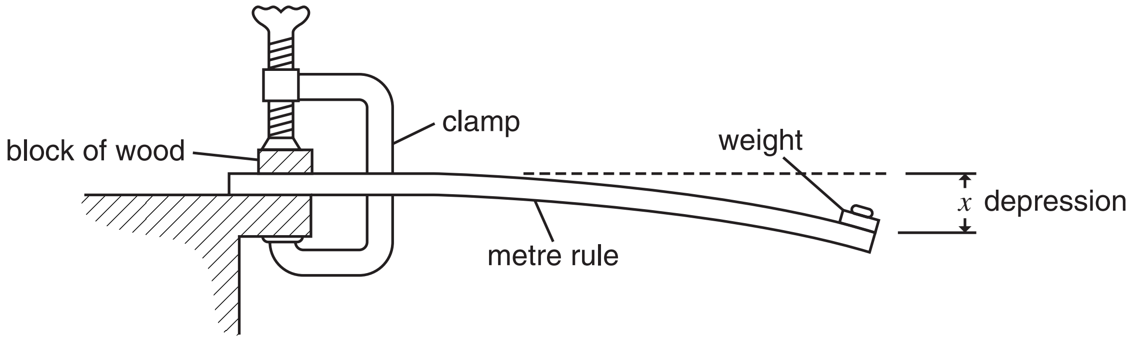


**Fig. 1.1**

In the experiment, the depression is found to be about 4 cm.

**(a)** Describe how you would determine the value of $x$ to the nearest mm. Your answer should include the following points.

**(i)** How you would locate the position of the horizontal line from which the depression is measured.

**(ii)** What apparatus you would use to help you measure the depression.

**(iii)** What practical steps you would take to improve the accuracy of your measurement.

You may draw diagrams if you wish.

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For Examiner's Use

**(b)** The free end of the loaded rule is now pushed down so that the depression is greater than $x$, and then the rule is released. The rule performs vertical oscillations. How would you determine the time, $T$, for one oscillation?

Your answer should include the following points.

**(i)** What measurements you would make and how you would use these measurements to determine $T$.

**(ii)** What equipment you would use to make the measurements.

**(iii)** How you would avoid making errors.

**(iv)** How you would try to reduce errors.

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[4]



**[Turn over**

**2** The class is using a beaker filled with water to investigate one of the effects produced by a cylindrical water lens. Fig. 2.1 shows the apparatus.

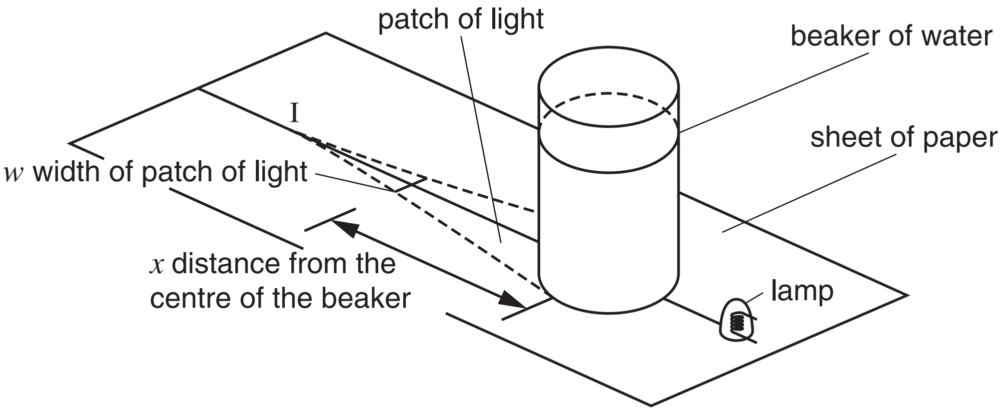


**Fig. 2.1**

A large sheet of paper is placed on the bench. A straight line is drawn along the centre of the sheet.

A beaker is placed with its centre on the straight line. The beaker of water acts as a cylindrical lens. A small lamp is placed on the line. The lamp acts as a bright object. The light that emerges on the other side of the lens produces a patch of light on the sheet of paper. The broken lines mark the edge of this patch of light. The width of the patch of light decreases and shows a sharp focus at the point I. At different points along the central line the width, $w$, of the patch of light is determined. The investigation is to discover how $w$ depends upon $x$, the distance from the centre of the beaker.

Fig. 2.2 is a full size copy of the patch of light obtained in one experiment.

**(a)** On Fig. 2.2, at the points denoted by $X_1$, $X_2$, $X_3$ and $X_4$, take measurements of the width, $w$, of the patch of light and the distance, $x$, from the centre of the lens. Record the values for $w$ and $x$ in a table.

Determine the values of the product $wx$, and include these values in your table.

[5]

**(b)** Describe how the values of $w$ change as the values of $x$ increase.

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For Examiner's Use

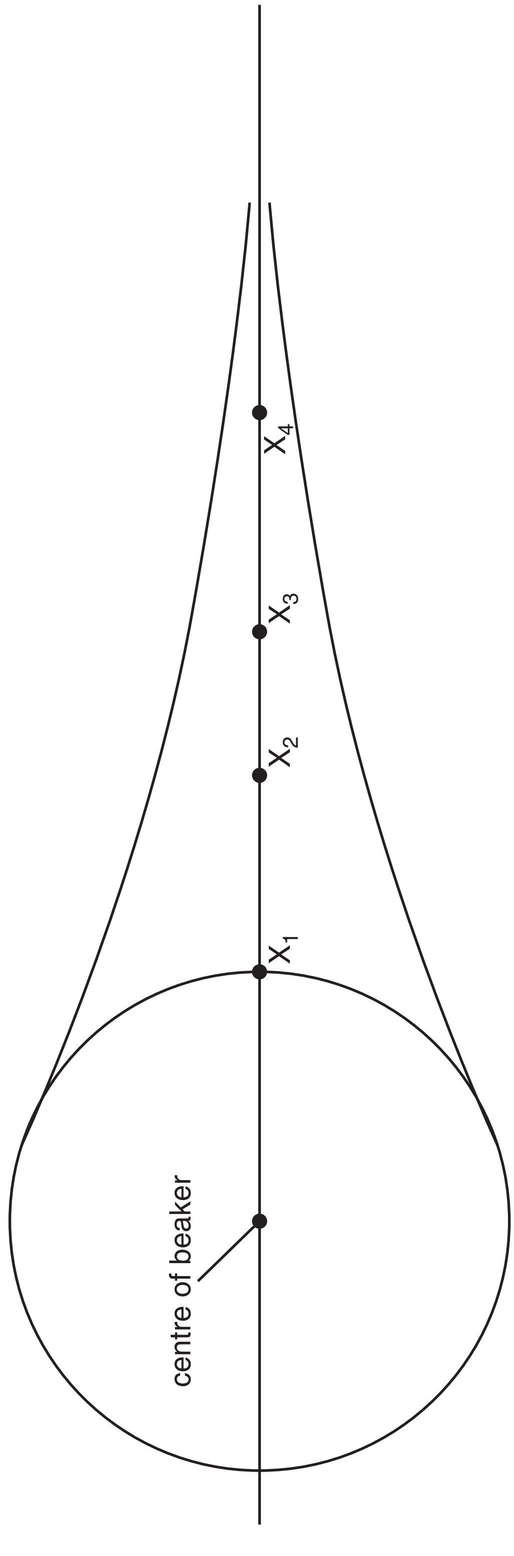


**Fig. 2.2**



**[Turn over**

**3** In this experiment, the class is investigating how the thermal energy lost by a 50 g mass of brass, initially at 100 °C, depends upon the time it is cooling. The apparatus is shown in Fig. 3.1.

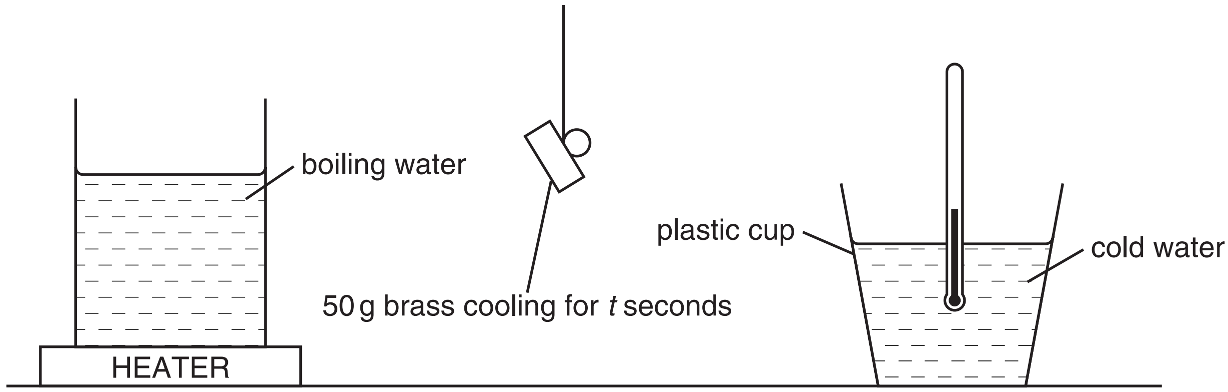


**Fig. 3.1**

A 50 g mass of brass is heated in boiling water for at least five minutes. The mass is then removed from the boiling water and given a very quick shake to remove any hot water remaining on the mass. A time *t*, after the brass has been removed from the boiling water, when the temperature of the brass has cooled to $\theta_H$, the 50 g mass is placed into 50 $cm^3$ of cold water. The initial temperature of the cold water is $\theta_C$. The temperature of the cold water rises and the maximum temperature $\theta_M$ is determined.

$\theta_H$ is then calculated using the following equation.

$$\theta_H = 11\theta_M - 10\theta_C$$

The experiment is repeated for different values of cooling time *t*.

Fig. 3.2 is a graph of a set of typical results for this experiment.

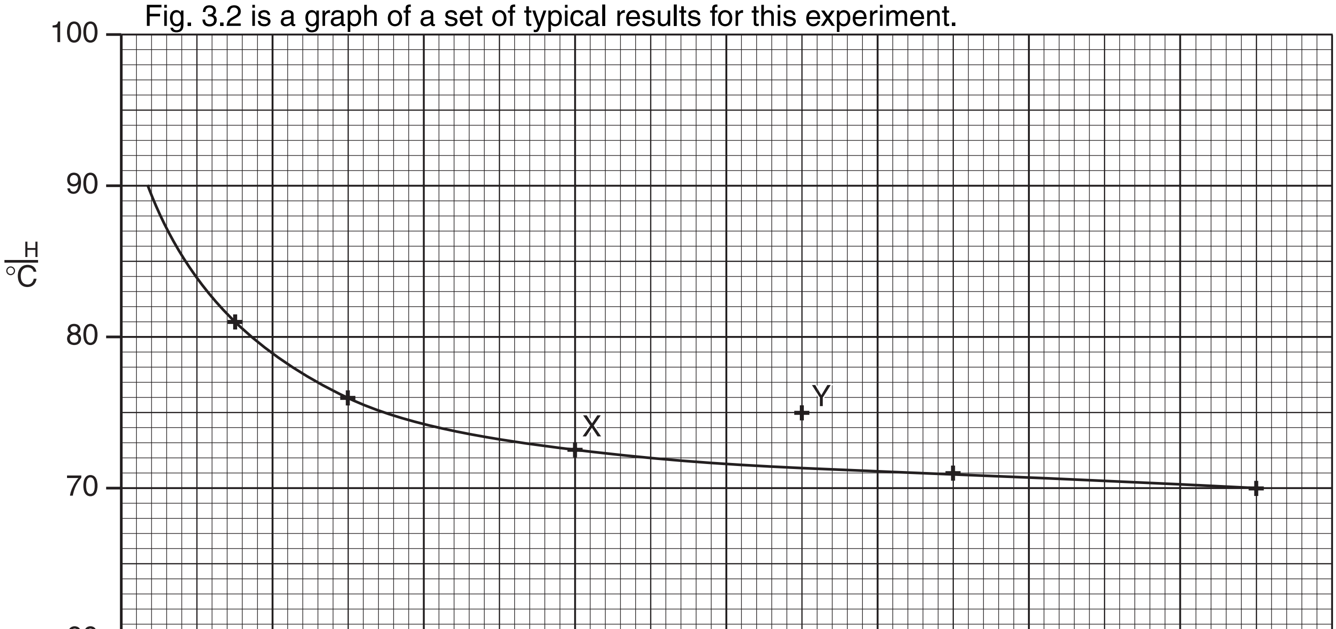


**Fig. 3.2**

For Examiner's Use

**(a)** Why is it important to remove any water remaining on the brass as soon as it is lifted from the boiling water?

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**(b)** You do not have a partner helping you with this experiment. How would you measure the cooling time *t*, using the clock shown in Fig. 3.3?

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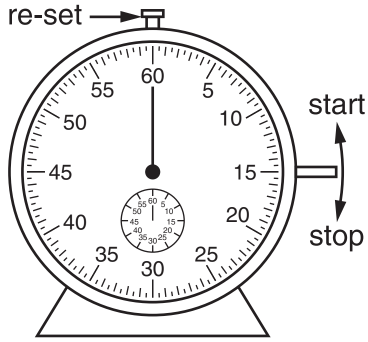


**Fig. 3.3**

**(c)** Describe how you would perform the experiment in order to obtain the values that will enable you to plot the point labelled **X** on the graph.

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**(d)** The point labelled **Y** does not lie close to the graph line and it is to be repeated.

**(i)** How would you ensure that the initial temperature of the cold water in the plastic cup is the same as in the previous trial?

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**(ii)** Measuring cylinders are not very accurate for measuring small volumes of water. How would you obtain 50 $cm^3$ of water with more accuracy than that obtained by using a measuring cylinder?

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**(e)** Why is it a good procedure to stir the cold water after adding the brass mass?

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**4** Fig. 4.1 is a series circuit in which a variable resistor is used so as to control the magnitude of the current in the circuit. The circuit is designed so as to obtain any value of current from 0.2 A to 2 A.

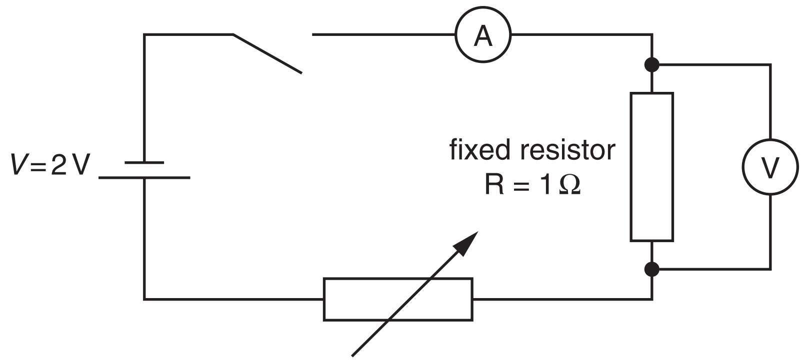


**Fig. 4.1**

**(a) (i)** The variable resistor is marked "0 to 10 Ω".

What is meant by the phrase "0 to 10 Ω"?

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**(ii)** Why is it important that the value of the variable resistance may be changed smoothly?

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**(b) (i)** A 1 m length of nichrome wire has a resistance of 10.0 Ω.

How would you use 1 m of this wire, and a jockey-slide contact, as the variable resistor shown in Fig. 4.1?

Your answer should

1. include a diagram showing the wire in use,
2. explain how you would achieve smooth changes in the value of the variable resistance,
3. explain why the wire must be bare and clean.

*Diagram*

For Examiner's Use

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**(ii)** If the current in the nichrome wire becomes 2.0 A, then the wire becomes very hot and has a temperature of about 300 °C. The wire is then dangerous to touch.

A safe current to use in the circuit is about 0.6 A. To obtain a current of 0.6 A, the **total** resistance in the circuit should be about 3.3 Ω. The length of resistance wire in use is then 23 cm.

What could you do to the apparatus you have been given in **(b)(i)** to prevent anyone using a length of resistance wire that is less than 23 cm?

You may draw a diagram if you wish.

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**5** A bar magnet A is placed on a waxed cardboard disc which floats on water as shown in Figs. 5.1 and 5.2. At first, magnet A points in the North-South direction. A similar magnet, B, is moved along the EW line as shown. As magnet B approaches magnet A, magnet A is deflected. The deflection, *y*, is measured. An experiment is performed to find out how *y* depends upon *x*, the distance between the centre of A and the centre of B.

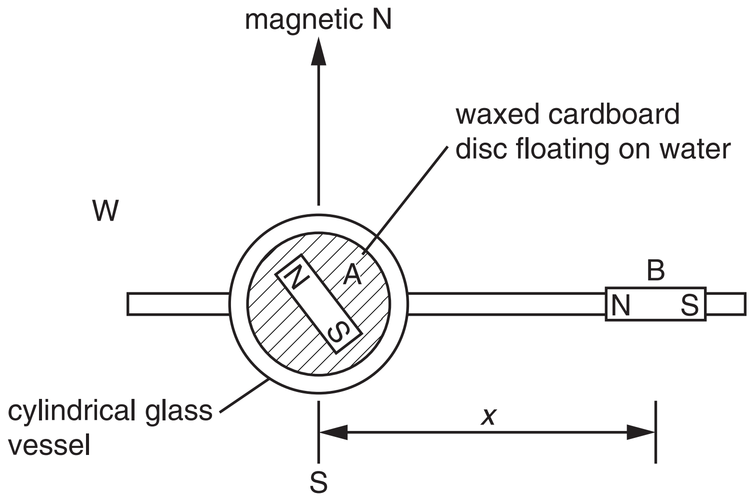



**Fig. 5.1**

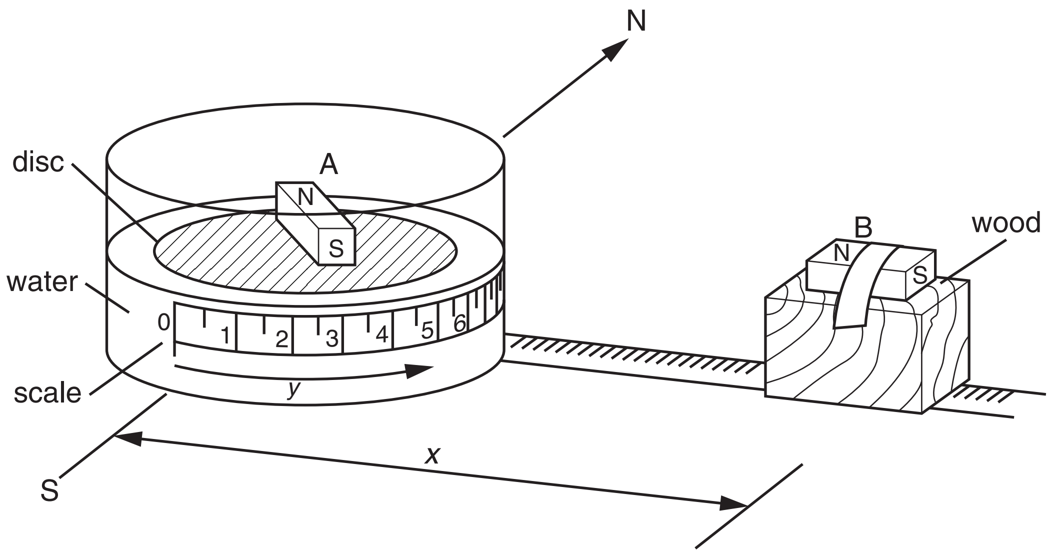


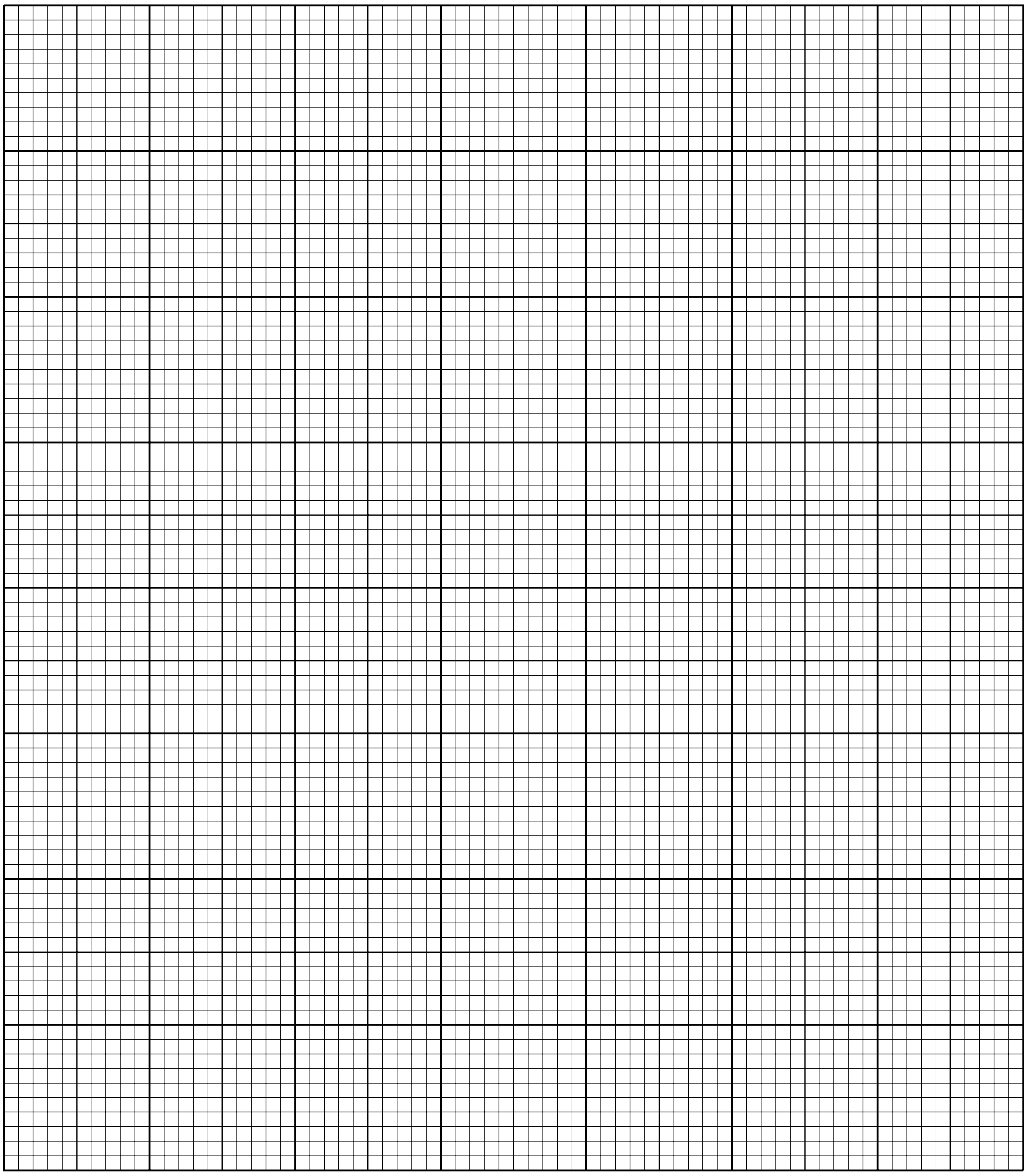

**Fig. 5.2**

The data obtained from the experiment are given in the table.

| deflection $y$/mm | 3 | 8 | 16 | 40.5 | 74.5 |
|---|---|---|---|---|---|
| separation $x$/mm | 600 | 400 | 300 | 200 | 150 |

For Examiner's Use

**(a)** Plot a graph of $y$/mm ($y$-axis) against $x$/mm ($x$-axis). Draw a smooth curve through the points. [5]



**(b) (i)** Use the graph to complete the table below.

| $x$/mm | | $y$/mm | |
|---|---|---|---|
| $x_1$ | 170 | $y_1$ | |
| $x_2$ | 600 | $y_2$ | |
| $x_1/x_2$ | | $y_1/y_2$ | |



**[Turn over**

For Examiner's Use

**(ii)** Given that an increase in *y* means an increase in the force between the magnets, describe how the force changes as the separation, *x*, decreases. Your answer should include a comment on the magnitude of the two ratios that you have calculated in part **(b)(i)**.

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